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Updating the California Vehicle-Grid Integration (VGI) Roadmap

Noel S. Crisostomo

Fuels and Transportation Division | Integrated Energy Policy Report Workshop - June 22, 2020

Outline

- Motivations for Vehicle-Grid Integration
- Activities that Parallel and Inform the VGI Roadmap Update
- Progress upon Four Tracks: Policy, Economics, Technology, Customers
- Rising to the Opportunities of Vehicle-Grid Integration
- Accelerating Forward



Motivations for Vehicle-Grid Integration (VGI): Widespread Transportation Electrification Requires VGI

Overarching VGI goals

- Reduce barriers to EV adoption:
 - saving drivers operational costs
 - reducing grid impacts to electricity users and utilities
 - creating opportunities for innovators to provide new customer services
- Hasten decarbonization and clean air benefits:
 - reducing electric sector GHGs by integrating renewable energy
 - Cutting harmful air pollution, especially in disadvantaged communities

Timeline of State Actions

- 2012: Executive Order B-16-2012 states "By 2020 EV charging will be integrated with the electricity grid"
- 2014: California Independent System Operator (CAISO) publishes California VGI Roadmap: Enabling Vehicle-based Grid Services
- 2018: CEC initiates process to update roadmap



Activities that Parallel and Inform Roadmap: Inter-Agency Activities

Utility Interconnection Rule 21

- - V2G DC (Stationary Inverter) V2G – AC (Mobile Inverter)

Research & Analysis



CALLEORNIA

- Electric Program Investment Charge (EPIC) Program
 - Distributed Energy Resources (DER) Research Roadmap



Working Group on Value



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Activities that Parallel and Inform Roadmap: Inter-Agency Activities

Rulemakings

- - Transportation Electrification Framework

Mobile Source Strategy + Regulations

- Load Management Rulemaking
- Energy Storage & DER (ESDER) Initiatives

Investment







The Four Tracks: Policy, Economics, Technology, Customers

2014 Roadmap identified 3 tracks

Policy – Interactions, barriers, and gaps in planning and determine interventions needed Economics – Compare benefits of charge management to facilitate business models Technology – Identify needs, delineating areas of commercialization vs. research

2020 Roadmap adds a new track

Customers – Expand equitable access to VGI, simplifying smart charging "for all"





Progress upon Track 1: Policy



Progress upon Track 1: Policy



Progress on Track 2: Economic Potential

Figure 5. Levelized Costs and Benefits for High Value Scenario Under Utility Control



9

Source: https://www.osti.gov/pages/servlets/purl/1557041

Progress on Track 3: Technology Development



Source: WAVE, Phoenix Contact, CHAdeMO, Tesla/Daimler/CharlN, EPRI

Progress on Track 4: Customer Behavior



Source: U.S. Housing and Urban Development Department

Transportation cost burdens

- Very low-income drivers in rural areas can spend 40-50% of their income on automobiles (left).
- The most burdened of very lowincome transit riders in urban areas can spend over 10% of their income on transit (not shown).
- Cost savings from VGI could help these Californians the most.



Rising to the Opportunities of Vehicle-Grid Integration

Improve health and air quality in frontline communities Microgrids following the deployment diesel generators Reliability amidst Public Safety Power Shutoffs DR during coastal heat grid overloads Resilience to drought and wildfire risks California's commitment to below 2°C Prospective withdrawal from Paris Agreement Automaker transformations post-Dieselgate EVs warrantied for V2G/X discharging 500-mile passenger EVs Million-mile batteries with plans for second lives Megawatt+ chargers for medium & heavy vehicles Wireless, mobile, off-grid, and service-based charging

Mass, low cost production of photovoltaics and clean generation Rapid scale-up of battery energy storage Increasing value of flexibility for high renewables Solid-state batteries without conflict materials Building electrification PV and load management within new construction Challenges in energization and interconnection Diversified investments from utility, oil and gas co.'s Electric utility investment in charging Smaller, less costly charger power electronics Low-latency communication + onboard computing First-cost EV parity with combustion engines by mid-2020s Automation and sharing of vehicles

Accelerating VGI Forward: Today's IEPR workshop

<u>Objective</u>: Widespread Transportation Electrification

• Learning from recent charging infrastructure programs (Panel 2)

Enabler: Technology Capabilities and Dispersion

• Facilitating advanced functions (Panel 1) and scaling to more drivers (Panel 3)

Enabler: Diverse Market Opportunities

• Encouraging new business models for infrastructure investments (Panel 4)



Accelerating VGI forward: Timeline to complete Roadmap Update

- Comments on workshop
 - (July 15)
- Revisions incorporating related activities
- Draft Roadmap: Workshop + Stakeholder Comments (September TBD)
- Final Roadmap: Publication and Business Meeting Consideration (Anticipated November)



Thank You!

Questions?

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